

**In the Claims:**

1. (Previously amended) A receiver for demodulating a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising:

a two-stage interpolator, responsive to digital samples of the data signal, that generates interpolated digital samples in response thereto, the digital samples having a first local sample rate that is synchronized with a local clock and the interpolated digital samples having a second local sample rate that is synchronized with the network clock, the two-stage interpolator comprising:

a time converter, responsive to a sampling index signal, that generates first and second integers in response thereto;

a polyphase interpolator, responsive to the digital samples of the data signal and the first integer, that generates first and second estimates for each of the digital samples of the data signal; and

a linear interpolator, responsive to the first and second estimates and the second integer, that generates the interpolated digital samples;

an adaptive fractionally spaced decision feedback equalizer, responsive to the interpolated digital samples, that generates equalized digital samples at the network sampling rate in synchronization with the network clock; and

a slicer, responsive to the equalized digital samples, that generates detected symbols therefrom corresponding to data from the data signal.

2. (Original) A receiver as recited in Claim 1, wherein the adaptive fractionally spaced decision feedback equalizer has a tap spacing given by  $pT/q$  where  $T$  is a modulation interval associated with the network sampling rate and  $p$  and  $q$  are integers.

3. (Previously amended) A receiver as recited in Claim 1, further comprising a clock synchronizer responsive to the detected symbols and generating the sampling index signal.

4. (Canceled)

5. (Canceled)

6. (Original) A receiver as recited in Claim 1, further comprising an echo canceller that couples a transmitter to the receiver, the echo canceller being responsive to transmit symbols from the transmitter that have a third local sample rate that is synchronized with the local clock and generating echo cancellation samples in response thereto at the first local sample rate in synchronization with the local clock.

7. (Original) A receiver as recited in Claim 6, further comprising an adder that combines the echo cancellation samples with the digital samples of the data signal.

8. (Original) A receiver as recited in Claim 6, wherein the echo canceller comprises an adaptive digital filter, responsive to the transmit symbols from the transmitter, that generates echo cancellation samples at the first local sample rate in synchronization with the receiver clock, which are complementary to a portion in each of the digital samples of the data signal that can be attributed to an echo signal from the transmitter.

9. (Original) A receiver as recited in Claim 1, further comprising:  
means for identifying a signaling alphabet used by the slicer to generate the detected symbols.

10. (Original) A receiver as recited in Claim 9, wherein the means for identifying comprises:

means for establishing a plurality of alphabet thresholds corresponding to valid data symbols;

means for computing an average value for the equalized digital samples corresponding to a particular alphabet threshold; and

means for updating the particular alphabet threshold with the average value.

11. (Original) A receiver as recited in Claim 1, wherein the detected symbols are pulse code modulation (PCM) codewords.

12. (Currently amended) A method for demodulating, in a receiver, a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising the steps of:

sampling the data signal to produce digital samples at a first local sample rate that is synchronized with a local clock;

generating first and second integers in response to a sampling index signal using a time converter;

interpolating the digital samples in response to the first integer to produce first and second estimates for each of the digital samples using a polyphase interpolator;

interpolating the first and second estimates in response to the second integer to produce interpolated digital samples having a second local sample rate that is synchronized with the network clock using a linear interpolator;

equalizing the interpolated digital samples to produce equalized digital samples using an adaptive fractionally spaced decision feedback equalizer; and

decoding the equalized digital samples to generate detected symbols therefrom.

13. (Currently amended) A method as recited in Claim 12, wherein the ~~equalizing step comprises the step of:~~

~~using an~~ adaptive fractionally spaced decision feedback equalizer ~~that~~ has a tap spacing given by  $pT/q$  where  $T$  is a modulation interval associated with the network sampling rate and  $p$  and  $q$  are integers ~~to produce the equalized digital samples.~~

14. (Previously amended) A method as recited in Claim 12, further comprising the step of:

maintaining the synchronization between the second local sample rate and the network clock via the sampling index signal.

15. (Canceled)

16. (Original) A method as recited in Claim 12, further comprising the steps of:

coupling a transmitter to the receiver with an echo canceller;  
receiving at an input of the echo canceller transmit symbols from the transmitter that have a third local sample rate that is synchronized with the local clock; and  
generating at an output of the echo canceller echo cancellation samples at the first local sample rate in synchronization with the local clock.

17. (Original) A method as recited in Claim 12, further comprising the step of identifying a signaling alphabet for use in the decoding step to generate the detected symbols.

18. (Original) A method as recited in 17, wherein the identifying step comprises the steps of:

establishing a plurality of alphabet thresholds corresponding to valid data symbols;  
computing an average value for the equalized digital samples corresponding to a particular alphabet threshold; and  
updating the particular alphabet threshold with the average value.

19. (Original) A method as recited in Claim 12, wherein the detected symbols are pulse code modulation (PCM) codewords.

20. (Currently amended) A computer program product for demodulating, in a receiver, a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising:

a computer readable storage medium having computer readable code means embodied therein, the computer readable code means comprising:

first logic configured to sample the data signal to produce digital samples at a first local sample rate that is synchronized with a local clock;

second logic configured to generate first and second integers in response to a sampling index signal using a time converter;


third logic configured to interpolate the digital samples in response to the first integer to produce first and second estimates for each of the digital samples, the third logic configured to interpolate comprising:

fourth logic configured to use a polyphase interpolator to produce the first and second estimates;

fifth logic configured to interpolate the first and second estimates in response to the second integer to produce interpolated digital samples having a second local sample rate that is synchronized with the network clock, the second logic configured to interpolate comprising:

sixth logic configured to use a linear interpolator to produce the interpolated digital samples;

seventh logic configured to equalize the interpolated digital samples to produce equalized digital samples using an adaptively fractionally spaced decision feedback equalizer; and

 eighth logic configured to decode the equalized digital samples to generate detected symbols therefrom.

21. (Currently amended) A computer program product as recited in Claim 20, wherein the ~~seventh logic configured to equalize comprises:~~

~~ninth logic configured to use an~~ adaptively fractionally spaced decision feedback equalizer ~~that~~ has tap spacing given by  $pT/q$  where  $T$  is a modulation interval associated with the network sampling rate and  $p$  and  $q$  are integers ~~to produce the equalized digital samples.~~

22. (Previously amended) A computer program product as recited in Claim 20, further comprising:

ninth logic configured to maintain the synchronization between the second local sampling rate and the network clock via the sampling index signal.

24. (Previously amended) A computer program product as recited in Claim 20, wherein the receiver further includes an echo canceller coupling a transmitter to the receiver, further comprising:


ninth logic configured to receive at an input of the echo canceller transmit symbols from the transmitter that have a third local sample rate that is synchronized with the local

clock; and

tenth logic configured to generate at an output of the echo canceller echo cancellation samples at the first local sample rate in synchronization with the local clock.

25. (Previously amended) A computer program product as recited in Claim 20, further comprising:

ninth logic configured to identify a signaling alphabet, the eighth logic configured to decode being responsive to the logic configured to identify.



26. (Previously amended) A computer program product as recited in Claim 25, wherein the ninth logic configured to identify comprises:

tenth logic configured to establish a plurality of alphabet thresholds corresponding to valid data symbols;

eleventh logic configured to compute an average value for the equalized digital samples corresponding to a particular alphabet threshold; and

twelfth logic configured to update the particular alphabet threshold with the average value.

27. (Original) A computer program product as recited in Claim 20, wherein the detected symbols are pulse code modulation (PCM) codewords.

28. (Previously added) A receiver for demodulating a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising:

a two-stage interpolator, responsive to digital samples of the data signal, that generates interpolated digital samples in response thereto, the digital samples having a first local sample rate that is synchronized with a local clock and the interpolated digital samples having a second local sample rate that is synchronized with the network clock;

an adaptive fractionally spaced decision feedback equalizer, responsive to the interpolated digital samples, that generates equalized digital samples at the network sampling

rate in synchronization with the network clock;

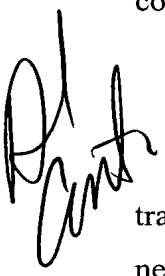
a slicer, responsive to the equalized digital samples, that generates detected symbols therefrom corresponding to data from the data signal; and

means for identifying a signaling alphabet used by the slicer to generate the detected symbols, comprising:

means for establishing a plurality of alphabet thresholds corresponding to valid data symbols;

means for computing an average value for the equalized digital samples corresponding to a particular alphabet threshold; and

means for updating the particular alphabet threshold with the average value.



29. (Previously added) A method for demodulating, in a receiver, a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising the steps of:

sampling the data signal to produce digital samples at a first local sample rate that is synchronized with a local clock;

interpolating the digital samples to produce first and second estimates for each of the digital samples;

interpolating the first and second estimates to produce interpolated digital samples having a second local sample rate that is synchronized with the network clock;

equalizing the interpolated digital samples to produce equalized digital samples;

decoding the equalized digital samples to generate detected symbols therefrom; and

identifying a signaling alphabet for use in the decoding step to generate the detected symbols, the identifying step comprising the steps of:

establishing a plurality of alphabet thresholds corresponding to valid data symbols;

computing an average value for the equalized digital samples corresponding to a particular alphabet threshold; and

updating the particular alphabet threshold with the average value.

30. (Previously amended) A computer program product for demodulating, in a receiver, a data signal transmitted from a digital source at a network sampling rate that is synchronized with a network clock, comprising:

a computer readable storage medium having computer readable code means embodied therein, the computer readable code means comprising:

first logic configured to sample the data signal to produce digital samples at a first local sample rate that is synchronized with a local clock;

second logic configured to interpolate the digital samples to produce first and second estimates for each of the digital samples;

third logic configured to interpolate the first and second estimates to produce interpolated digital samples having a second local sample rate that is synchronized with the network clock;

fourth logic configured to equalize the interpolated digital samples to produce equalized digital samples;

fifth logic configured to decode the equalized digital samples to generate detected symbols therefrom;

sixth logic configured to identify a signaling alphabet, the fifth logic configured to decode being responsive to the logic configured to identify, the sixth logic configured to identify comprising:

seventh logic configured to establish a plurality of alphabet thresholds corresponding to valid data symbols;

eighth logic configured to compute an average value for the equalized digital samples corresponding to a particular alphabet threshold; and

ninth logic configured to update the particular alphabet threshold with the average value.